

## LISTS OF SPECIES

### Bats from the Restinga of Praia das Neves, state of Espírito Santo, Southeastern Brazil

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#### Abstract

Studies on bat richness and diversity in coastal sand dunes ('restinga') are still scarce. Therefore, the objectives of the present study were to estimate bat richness in the *restinga* of Praia das Neves (state of Espírito Santo, southeastern Brazil) and to analyze species abundance. Ten sampling nights were carried out in May and July 2008, resulting in a sampling effort of 21,847.5 h.m<sup>2</sup>. We captured 125 individuals from 17 bat species. In this study, *Tonatia saurophila* was recorded for the first time not only in the state of Espírito Santo but also in the *restinga* ecosystem. The most abundant species was *Artibeus lituratus* with 32% of all captures. Surveys in coastal *restingas* are urgently needed in order to obtain more information about the bats living in this environment.

#### Introduction

One of the most scarcely sampled ecosystems in Brazil are coastal sand dunes (hereafter '*restingas*'), which according to the current classification of IBGE's (*Instituto Brasileiro de Geografia e Estatística* - Brazilian Institute of Geography and Statistics) are part of the ecological region of the Lowland Dense Rain Forest (Veloso et al. 1991), within the Atlantic Forest biome (for a review of biomes see Olson et al. 2001). Scarano (2002) recommend considering the Atlantic Forest as a vegetation complex, in which the *restinga* is a particular vegetation type.

Since *restingas* are coastal ecosystems, real estate business and other human activities make them one of the most threatened kinds of vegetation (Rocha et al. 2003), which has been submitted to a process of intense disturbance (Lacerda and Esteves 2000; Tanizaki-Fonseca and Moulton 2000). These environments, composed of dunes and sandy beaches, and dominated by herbaceous and shrubby vegetation, are considered fragile due to their characteristically barren soil, mainly composed of unconsolidated sand (Hay et al. 1981).

Studies on the fauna of the coastal *restinga* are still scarce (e.g. Cerqueira et al. 1990; Rocha et al. 2004) and only during the past few years Brazilian

*restingas* have been target of more systematized studies, including flora and fauna inventories (Cerqueira 2000; Lacerda and Esteves 2000; Pereira and Araújo 2000; Rocha 2000; Bergallo et al. 2004; Oprea et al. in press).

The workshop "Avaliação e Ações Prioritárias para a Conservação da Biodiversidade da Mata Atlântica e Campos Sulinos - Assessment and Priority Actions for Biodiversity Conservation of the Atlantic Forest and Southern Grasslands" (MMA 2000) defined 14 priority areas for biodiversity conservation in the state of Espírito Santo, and Praia das Neves was classified as an area of "very high biological significance". However, this region does not have any protected area to ensure its long term conservation, and the knowledge on its fauna is poor (Araújo 1994; Rocha et al. 2003; Rocha and Bergallo 1997).

Studies on bat richness and diversity have increased in the past decades (Esbérard and Bergallo 2005; Brito et al. 2009). Though in Brazil most bat inventories were carried out in the southern and southeastern regions of the Atlantic Forest (Uieda and Pedro 1996; Bergallo et al. 2003; Esbérard and Bergallo 2005), there are still areas where basic knowledge such as species lists

## LISTS OF SPECIES

are absent or outdated (e.g. Miretzki 2003), and this is true in most of the Brazilian territory.

The knowledge about the biodiversity of different localities is important for comparisons among areas and planning of conservation policies (Humphries et al. 1995). Therefore, the objectives of the present study were to assess the local bat richness in the coastal *restinga* of Praia das Neves and to analyze species composition and relative abundance.

### Material and methods

Praia das Neves ( $21^{\circ}15' S$ ,  $40^{\circ}58' W$ ) is located on the riverbank of the Itabapoana river, Presidente Kennedy municipality, between the states of Espírito Santo and Rio de Janeiro. It still has some coastal *restinga* remnants.

Two bat capture sessions were carried out in 2008 (May 8-11 and July 17-23), in a total of 10 sampling nights. We used  $9 \times 2.5$  m mist nets and the number of nets set up every night varied from 10 to 16. We searched for roosts in local residences aiming at bats of the family Molossidae.

Several habitats were sampled in order to increase the probability of recording more species (Voss and Emmons 1996; Bergallo et al. 2003): swamp, *restinga* forest, orchard, shrubs with *Clusia*, shrubs without *Clusia*, and underbrush vegetation (see Rocha et al. 2004 for habitat types).

The sampling effort was calculated as suggested by Straube and Bianconi (2002), and the capture efficiency was calculated as the number of captures divided by the sampling effort. The expected richness and the completeness of our sample were calculated using Chao estimator (Chao 1984) with an online software (available at <http://www2.biology.ualberta.ca/jbrzusto/rarefact.php#ColCod1994>).

Bats were removed from the net during inspections carried out at intervals of 15-20 min, identified, measured, marked with plastic collars with colored cylinders (Esbérard and Daemon

1999) and released at the same site, usually from one to three hours after capture. One or two individuals of each species were killed, except for species that are considered as threatened in Brazil, to be deposited as vouchers in the collection of *Laboratório de Diversidade de Morcegos* at Universidade Federal Rural do Rio de Janeiro (license # 1755/89 IBAMA-RJ).

### Results and discussion

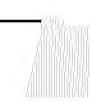
We carried out 77.5 sampling hours and accomplished a sampling effort of  $21,847.5 \text{ h.m}^2$ . A total of 125 specimens of 17 bat species were captured (Table 1). Among them, 26 individuals were captured inside the roof of a residence: 14 *Molossus rufus* E. Geoffroy, 1805 and 12 *Molossus molossus* (Pallas, 1766). *Molossus rufus* was not captured in mist nets, what suggests the importance of using alternative capture methods (Esbérard and Bergallo 2008).

The expected richness calculated with Chao's estimator was  $29.25 \pm 9.65$  species and the completeness of our sample was 58.12%. Therefore, we conclude that more nights would be necessary in order to properly sample this local assemblage.

In the present study, *Tonatia saurophila* Koopman and Williams, 1951 was recorded for the first time not only in the state of Espírito Santo but also in the coastal *restinga* environment. Two of the captured species are considered as threatened: *Artibeus cinereus* (Gervais, 1856) is classified as "vulnerable" in the threatened species list of the state of Rio de Janeiro (Bergallo et al. 2000), and *Platyrrhinus recifinus* (Thomas, 1901) is classified as "vulnerable" in the threatened species lists of Brazil, Rio de Janeiro, and São Paulo (São Paulo 1998; Bergallo et al. 2000; Machado et al. 2005).

There are no available data on bat capture efficiency in coastal *restinga* areas, but the capture efficiency in this study was low ( $0.006 \text{ captures/h.m}^2$ ) and even lower than recorded in other Atlantic Forest environments (see Esbérard 2003; Esbérard and Bergallo 2008).

LISTS OF SPECIES



**Table 1.** Bat species captured in Praia das Neves, state of Espírito Santo, in 2008.

Species	Captures
<b>Family Phyllostomidae</b>	
<i>Phyllostomus discolor</i> Wagner, 1843	2
<i>Glossophaga soricina</i> (Pallas, 1766)	5
<i>Tonatia saurophila</i> Koopman and Williams, 1951	2
<i>Carollia perspicillata</i> (Linnaeus, 1758)	13
<i>Artibeus cinereus</i> (Gervais, 1856)	7
<i>Artibeus fimbriatus</i> Gray, 1838	3
<i>Artibeus lituratus</i> (Olfers, 1818)	40
<i>Platyrrhinus lineatus</i> (E. Geoffroy, 1810)	18
<i>Platyrrhinus recifinus</i> (Thomas, 1901)	1
<i>Uroderma magnirostrum</i> Davis, 1968	1
<b>Family Noctilionidae</b>	
<i>Noctilio leporinus</i> (Linnaeus, 1758)	1
<b>Family Molossidae</b>	
<i>Eumops auripendulus</i> (Shaw, 1800)	1
<i>Molossus rufus</i> E. Geoffroy, 1805	14 (14)*
<i>Molossus molossus</i> (Pallas, 1766)	14 (12)*
<b>Family Vespertilionidae</b>	
<i>Lasiurus blossevillii</i> (Lesson and Garnot, 1826)	1
<i>Myotis nigricans</i> (Schinz, 1821)	1
<i>Myotis cf riparius</i> Handley, 1960	1

(\*) captured by hand in one of the roofs searched.

*Artibeus lituratus* (Olfers, 1818) was the most common species comprising 32.0% of all captures, followed by *Platyrrhinus lineatus* (E. Geoffroy, 1810) with 14.4%. Fogaça and Reis (2008) and Oprea et al. (in press) analyzed several studies developed in coastal restingas and, corroborating the results of the present study, found a dominance of *A. lituratus* in most localities. However, in *Parque Nacional da Restinga de Jurubatiba* (Jurubatiba Restinga National Park), state of Rio de Janeiro, *Carollia perspicillata* (Linnaeus, 1758) was the dominant species (unpublished data R. Mangolin). In the present study, this species exhibited intermediate abundance (Table 1).

Although data from 14 different sites in coastal restinga are available (Fogaça and Reis 2008; Oprea et al. in press), the total amount of captures considering all studies pooled together (less than 2,000 captures and recaptures in this environment) is still insufficient for comparisons with other

vegetation types, since most of the sampled localities have less than 200 captures. However, it is possible to observe that at least 35 species were already recorded in coastal *restingas* between the states of Espírito Santo and Paraná.

According to Bergallo et al. (2003), in order to properly sample bat species richness, a large sampling effort is required, which includes different sampling sites. Taking into account the small sampling effort of this study, the richness obtained here is similar to other coastal *restingas* previously sampled, where local richness was not higher than 16 species (e.g. Oprea et al. in press).

Besides mist nets, the use of other sampling methods would undoubtedly add more species to the list, since many bat families (Emballonuridae, Molossidae, Thyropteridae, Natalidae, Furipteridae and Vespertilionidae) have well-developed echolocation and thus are able to detect and avoid

## LISTS OF SPECIES

nets (Voss and Emmons 1996), or usually fly high above nets (Findley 1993) and have low capture efficiency in mist nets.

A high number of *M. molossus* and *M. rufus* roosts was observed in residences, as predicted by Esbérard et al. (1999). In one occasion

cohabitation and contact between the two species was observed inside one of the roosts visited.

Surveys in coastal *restingas* are urgently needed in order to obtain more information about the bats that live in this environment.

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## Appendix 1

Voucher list: *Artibeus lituratus* (LDM4888 and LDM4902); *Artibeus cinereus* (LDM4887 and LDM4890); *Carollia perspicillata* (LDM4892); *Glossophaga soricina* (LDM4895 and LDM4900); *Phyllostomus discolor* (LDM4938 and LDM4939); *Platyrrhinus lineatus* (LDM4889 and LDM4894); *Tonatia saurophila* (LDM4904 and LDM4905);

## LISTS OF SPECIES

*Uroderma magnirostrum* (LDM4893); *Noctilio leporinus* (LDM4896); *Eumops auripendulus* (LDM4901); *Molossus molossus* (LDM4897 and LDM4898); *Molossus rufus* (LDM4899); *Lasiurus blossevillii* (LDM4903); *Myotis cf riparius* (LDM4940).